

Sub-A
B2
 What is claimed is:

1. A system for bi-directional transmission of optical signals over a single optical medium coupled between at least two nodes, said system utilizing a first optical transmission band for signals traveling in a first direction and a second optical transmission band for signals traveling in a second direction, said system comprising:

at least a first combiner/separator unit at a first of said two nodes, said first combiner/separator including an input port, an output port and a bi-directional input/output port for coupling to said single optical medium, a first optical filter within said first combiner/separator unit coupled to each of said ports therein, said optical filter being substantially transmissive to optical signals of said first band entering said input port and exiting on said bi-directional input/output port and said filter being substantially reflective for signals of said second band entering said bi-directional input/output port and exiting on said output port; and

at least a second combiner/separator unit at a second of said two nodes, said second combiner/separator including an input port, an output port and a bi-directional input/output port coupled to said optical medium, a second optical filter within said second combiner/separator unit coupled to each of said ports therein of said second combiner/separator unit, said second optical filter being substantially transmissive to optical signals of said second band entering said input port and exiting on said bi-directional input/output port and said filter being substantially reflective for signals of said first band entering said bi-directional input/output port and exiting on said single direction output port.

2. The system of Claim 1, further including at least one intermediate node, said intermediate node comprising:

at least one said first combiner/separator unit and at least one second combiner/separator unit, and

at least a first and second optical amplifier, said output port of said first combiner/separator unit coupled to said input port of said second combiner/separator unit through said first optical amplifier, said output port of said second combiner/separator unit coupled to said input port of said first combiner/separator unit through said second optical amplifier;

10 said first and second combiner/seperator units being alternately coupled within
 11 said bi-directional transmission system such that pairs of said first and second
 12 combiner/seperator units are utilized in combination, said bi-directional ports of said
 13 combiner/seperator units being coupled to one another.

1 3. The system of Claim 1, wherein said optical transmission bands are L-
 2 band and C-band.

1 4. The system of Claim 1, wherein said first node includes a first set of one
 2 or more optical translator units for translating received wavelengths to wavelengths of
 3 said first transmission band, said optical translator units being coupled to an optical
 4 multiplexer unit and said optical multiplexer unit being coupled to said input port of said
 5 first combiner/seperator unit;

6 said output port of said first combiner/seperator unit couple to an optical
 7 demultiplexer unit, said optical demultiplexer unit coupled to a second set of optical
 8 translator units for translating wavelengths of said second transmission band to said
 9 received wavelengths.

1 5. The system of Claim 4, wherein said first node further includes at least
 2 one optical amplifier coupled between an output of said multiplexer and said input port of
 3 said first combiner/seperator unit and at least one optical amplifier coupled between said
 4 output port of said first combiner/seperator unit and an input of said demultiplexer.

1 6. The system of Claim 1, wherein said second node includes a first set of
 2 one or more optical translator units for translating received wavelengths to wavelengths
 3 of said second transmission band, said optical translator units being coupled to an optical
 4 multiplexer unit and said optical multiplexer unit being coupled to said input port of said
 5 second combiner/seperator unit;

6 said output port of said second combiner/seperator unit coupled to an optical
 7 demultiplexer unit, said optical demultiplexer unit coupled to a second set of optical
 8 translator units for translating wavelengths of said first transmission band to said received
 9 wavelengths.

7. The system of Claim 6, wherein said second node further includes at least one optical amplifier coupled between an output of said multiplexer and the input port of said second combiner/seperator unit and at least one optical amplifier coupled between said output port of said combiner/seperator unit and an input of said demultiplexer.

8. The system of Claim 1, wherein said filters included in each of said first and second combiner/seperator units are thin film wide-band filters.

9. The system of Claim 3, wherein said C-band and L-band filters include a transmissive insertion loss in the range of 1.3 to 1.7 dB and reflective insertion loss in the rang of 0.3 to 0.9 dB.

10. The system of Claim 2, wherein said intermediate node includes co-located end terminals.

11. The system of Claim 2, wherein said intermediate node includes optical add/drop terminals.

12. A system for bi-directional transmission of optical signals over a single optical fiber, said system including at least two nodes having said optical fiber coupled therebetween, said system utilizing only two distinct optical transmission bands, a single one of said bands for transmission of said optical signals in one of two directions, the other of said bands for transmission of said optical signals in the opposite direction, said system comprising:

at least a first and second combiner/seperator unit, at least one combiner/seperator unit located at each of said two nodes, each said combiner/seperator unit including an input port, an output port and a bi-directional input/output port for coupling to said single optical fiber, an optical filter within said combiner/seperator units/coupled to each of said ports, each said combiner/seperator unit operable to direct optical signals entering said input port through said filter to said bi-directional input/output port and to reflect optical signals entering said bi-directional input/output port off of said filter to said output port;

said optical filter in said first combiner/seperator unit being substantially transmissive to a first of said two bands and substantially reflective to optical signals in said second band traveling in an opposite direction;

17 said filter in said second combiner/seperator unit being substantially transmissive
18 to signals in said second band and substantially reflective for signals of said first band
19 traveling in an opposite direction; and

20 said first and second combiner/seperator units being alternately coupled within
21 said bi-directional transmission system such that pairs of said first and second
22 combiner/seperator units are utilized in combination, said bi-directional ports of said
23 combiner/seperator units being coupled to one another.

1 13. The system of Claim 12, further including at least one intermediate node,
2 said intermediate node comprising:

3 at least one said first combiner/seperator unit and at least one second
4 combiner/seperator unit, and

5 at least a first and second optical amplifier, said output port of said first
6 combiner/seperator unit coupled to said input port of said second combiner/seperator unit
7 through said first optical amplifier, said output port of said second combiner/seperator
8 unit coupled to said input port of said first combiner/seperator unit through said second
9 optical amplifier.

1 14. The system of Claim 12, wherein an end node in said system includes
2 either a first or second combiner/seperator unit, said end node further including a first set
3 of one or more optical translator units for translating received wavelengths to
4 wavelengths of one of said two distinct transmission bands, said optical translator units
5 being coupled to an optical multiplexer unit and said optical multiplexer unit being
6 coupled to said input port of said combiner/seperator unit; and

7 said output port of said combiner/seperator unit coupled to an optical
8 demultiplexer unit, said optical demultiplexer unit coupled to a second set of optical
9 translator units for translating wavelengths of said other of said two transmission bands to
10 said received wavelengths.

1 15. The system of Claim 14, wherein said end node further includes at least
2 one optical amplifier coupled between an output of said multiplexer and the input port of
3 said combiner/seperator unit and at least one optical amplifier coupled between said
4 output port of said combiner/seperator unit and an input of said demultiplexer.

1 16. The system of Claim 12, wherein said filters included in each of said first
2 and second combiner/seperator units are thin film wide-band filters.

1 17. The system of Claim 16, wherein said C-band and L-band filters include a
2 transmissive insertion loss in the range of 1.3 to 1.7 dB and reflective insertion loss in the
3 rang of 0.3 to 0.9 dB.

1 18. The system of Claim 12, wherein said transmission bands are selected
2 from the group consisting of L-band/C-band, C-band/S-band, C1 band/C2 band and S-
3 band/L-band.

1 19. The system of Claim 12, wherein said intermediate node includes co-
2 located end terminals.

1 20. The system of Claim 12, wherein said intermediate node includes optical
2 add/drop terminals.

1 *Sub A 7* 21. A method for bi-directional transmission of optical signals over a single
2 optical fiber coupled between two nodes, said method utilizing only two distinct optical
3 transmission bands, a single one of said bands for transmission of said optical signals in
4 one of two directions, the other of said bands for transmission of said optical signals in
5 the opposite direction, said method comprising:

6 providing at least a first and second combiner/seperator unit, at least one
7 combiner/seperator unit located at each of said two nodes, said combiner/seperator units
8 each including an input port, an output port and a bi-directional input/output port for
9 coupling to said single optical fiber, an optical filter within said combiner/seperator units
10 coupled to each of said ports, each of said combiner separator units operable to direct
11 optical signals entering said input port through said filter to said bi-directional
12 input/output port and to reflect optical signals entering said bi-directional input/output
13 port off of said filter to said output port

14 said optical filter in said first combiner/seperator unit being substantially
15 transmissive to a first of said two bands and substantially reflective to optical signals in
16 said second band traveling in an opposite direction,

